An Analysis of State Guaranty Fund Assessments for Property/Casualty Insurers from 1979-90*

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Abstract:

This study analyzes features of property and liability insurance guaranty funds and net assessments on a state-by-state basis over the 12-year period ending in 1990. Previous research has looked at individual company risk factors in predicting insolvency (and resulting guaranty fund assessments). Others have determined risk-based assessment premiums based on insurer characteristics to be used by guaranty funds. This paper examines macroeconomic and industry factors that explain net assessments by state guaranty funds. Macro-level factors considered in explaining net assessments are statewide direct written premiums, catastrophes, the market share of leading insurers in the state, interest rate changes, and the market impact of large insurer insolvencies in each state. The findings suggest funding advantages for large guaranty funds for catastrophes and that the net assessments of larger guaranty funds are more adversely affected by interest rate changes.

Introduction

The solvency and solidity of property and liability insurance companies is a subject of serious concern among regulators and consumers of insurance products. When insurers fail, there is widespread impact upon economic units throughout the marketplace in the form of unpaid claims and insurance paid for but not provided (unearned premiums). Since the regulation of insurance is a state function, all states have established guaranty funds to cushion such shocks to the economy.

The focus of this research is upon "net assessments" which is the differences between what guaranty funds collect in assessments and what is recovered in the liquidation of insolvent insurers. The level of net assessments should logically be related to the number and size of insolvencies. As a major function of regulation is the prevention of insolvencies, net assessments

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is an indication of regulatory success as well as a measure of efficiency of the guaranty fund mechanism. The purpose of this research is to explore differences in "net assessments" by state guaranty funds and seek to explain such differences with reference to macroeconomic and industry factors. This study identifies some of the general factors that influence the level of net assessments and examines the relative importance of each factor in explaining net assessments.

Non-Life Insurance Company Guaranty Funds

All state regulation recognizes the need to reduce the financial distress of an insurer insolvency. In December 1969, the National Association of Insurance Commissioners (NAIC) promulgated a model bill, the Post-Assessment Property and Liability Insurance Guaranty Association Model Act. The model bill proposed creation of a mechanism designed to pay claims due from insolvent insurers licensed to do business in the state with a maximum claim of $300,000. Today only New York maintains a pre-loss assessment fund. The other states operate on a post-assessment basis, where assessments are made against insurers doing business in the state only after an insolvency and only sufficient to pay claims against the insolvent insurer.

Most apply a flat rate assessment based on volume of business written by the assessed company. Critics suggest that flat rate post- loss assessments encourage excessive risk taking by insurers where the less risky companies subsidize the risk taking proclivities of some other companies. The NAIC reexamined the 1969 Model Act in 1984. In December 1985, amendments were approved to limit the liability of the guaranty fund. These amendments: (1) eliminated guaranty fund coverage for certain classes of liability risks, (2) established a $10,000 limit on claims for unearned premiums, and (3) granted statutory subrogation rights for liability claims paid on behalf of insureds with net worth in excess of $50 million.

A recent General Accounting Office (GAO) study concludes, however, that variety between funds is substantial (GAO, 1992). The GAO found 29 funds met all claim coverages, 4 set higher limits than 300,000, and 18 had lower limits than one or more of the NAIC claim limits standards. The GAO questions whether such variation is fair to policyholders and claimants.

The issue of who ultimately pays for losses after cost shifting is an important issue that varies between states. The NAIC Model Act suggested an optional partial premium tax offset, whereby assessed insurers take a premium tax credit over five years to recover guaranty fund assessments. As of November 1991, the National Conference of Insurance Guaranty Funds identified 14 states as having adopted premium tax offsets: 50 percent per year (LA), 33 percent per year (MO), 25 percent per year (TN), or 20 percent per year (AL, AR, AZ, NE, NV, OR, TX, UT, WA). Indiana and Kansas have recoupment provisions that supplement premium tax offsets with rate and premium increases. Clearly, where premium tax offsets apply, the ultimate losses are spread more broadly over the general taxpaying public instead of solvent company policyholders or stockholders or by insurance consumers.

The more common approach adopted by states is to contain the loss costs within the insurance mechanism. Three states (CA, HI, NJ) and Puerto Rico provide that solvent insurers may recoup the guaranty fund assessments through a premium surcharge while the remaining states have guaranty funds that allow recovery of assessments through "rates and premiums" which is a distinction without a great deal of difference. Clearly in these arrangements, whether

policyholders, stockholders, or insurance consumers in general pay depends on the companies' relative ability to pass the costs along in rates.

Table 1 summarizes just a few of the many complex characteristics of property and liability guaranty funds. In varying degrees funds do not cover life, accident and health, financial guaranty, mortgage guaranty, disability, surety, credit, ocean marine, and title insurance. A good number do not cover workers' compensation. Almost all state guaranty funds have maximum assessments in a given year of 1 percent to 2 percent of direct written premiums in covered lines of business the preceding year. Assessment recovery is available from companies and always is based on either direct written premiums or direct written premiums for the type of business covered in the assessment. Most guaranty funds limit coverage to claims of residents of the state for claims incurred within between 15 and 60 days of court order of liquidation.

Other Literature

Research on guaranty funds in the insurance industry was sparse during the 1970s and early 1980s. Interest has increased more recently as a large number (with substantial dollar value) of insolvencies have occurred since the mid-1980s.

Krogh (1972), writing shortly after the original NAIC Model Act, thoroughly reviewed and catalogued property and liability insolvency funds and discussed advantages and disadvantages of pre-loss and post- loss approaches, theoretical concepts of insurability of the insolvency risk, and possible federal government roles in the guaranty fund mechanism.

Munch and Smallwood (1980) report evidence concerning the effects of solvency regulation. They compare the characteristics of 33 insolvent insurers that failed during the 1969-76 time period with a corresponding solvent firm. Their analysis implies that the probability of insolvency is likely to increase for insurers that write more market competitive lines, have a high risk preference, possess a relatively small stock of intangible capital, and are permitted by law to withdraw capital relatively easily through dividends or other transfers.

TABLE 1

Summary of Property and Casualty Insurance Guaranty Association Acts by State
(and District of Columbia and U.S. Territories)

State	Major Non-Covered Lines[1]	Deduct-ible	Max. Per Claim	Non-Covered Claims[2]	Max. Annual Assessment[3]	Recoupment Provision[4]	Guaranty Fund Trigger[5]
AL	L,AH,M,D,S,C,T,O	$100	$150,000		1%/ACCOUNT	20% PTO	FOL & INSOLV
AK	L,M,D,S,C,T,O	$100	$300,000		2%/ACCOUNT	RP	INSOLV ONLY
AZ	L,M,D,S,C,T,O,W	$100	$100,000	PLF	1%/ACCOUNT	20% PTO	INSOLV ONLY
AR	L,AH,F,M,D,C,T,O	NONE	$300,000	PLF,PD	2% TOT PREM	20% PTO	INSOLV ONLY
CA	L,AH,F,M,D,S,C,T,O	$100	$500,000	PLF,PD	1%/ACC & 1%TP	PS	APPOINT OF LIQ
CO	L,AH,F,M,D,S,C,T,O	$100	$100,000		1%/ACCOUNT	RP	FOL & INSOLV
CT	L,AH,F,M,S,C,T,O	$100	$300,000		2%/ACCOUNT	RP	INSOLV ONLY
DE	L,AH,F,M,D,S,C,T,O	NONE	$300,000	PD	2% TOT PREM	RP	FOL & INSOLV
DC	L,M,D,T	$100	$300,000		2%/ACCOUNT	RP	INSOLV ONLY
FL	L,AH,F,M,D,S,C,T,O	$100	$300,000		2%/ACCOUNT	RP	FOL & INSOLV
GA	L,AH,F,M,D,S,C,T,O	$25	$100,000	PD	2%/ACCOUNT	RP	FOL & INSOLV
HI	L,AH,F,M,D,S,C,T,O	NONE	$300,000	PD	2% TOT PREM	PS	INSOLV ONLY
ID	L,M,D,S,C,T,O	$100	$300,000		1%/ACCOUNT	RP	INSOLV ONLY
IL	L,AH,F,M,S,O	NONE	$300,000	PD	1%/ACCOUNT	RP	FOL & INSOLV
IN	L,AH,F,M,D,S,C,T,O	NONE	$100,000	PLF,GD	1%/ACCOUNT	PTO OR RP	FOL & INSOLV
IA	L,AH,F,M,D,S,C,T,O	$100	$300,000	PLF,PD	2% TOT PREM	RP	FOL & INSOLV
KS	L,AH,M,T	$100	$300,000		2% TOT PREM	PTO OR RP	INSOLV ONLY
KY	L,AH,M,C,T,O	NONE	$100,000		1% TOT PREM	RP	FOL & INSOLV
LA	L,AH,F,M,D,S,C,T,O	$100	$150,000	PLF	2% TOT PREM	PTO ≤ 50%	FOL & INSOLV
ME	L,AH,F,M,C	NONE	$300,000	PD	2%/ACCOUNT	RP	INSOLV ONLY
MD	L,AH,M	$100	$300,000		2%/ACCOUNT	RP	FOL & INSOLV
MA	L,AH,F,M,D,S,C,T,O	NONE	$300,000		2% TOT PREM	RP	INSOLV ONLY
MI	L,D	$10	.05% PREM.	PLF	1% TOT PREM	RP	APPOINT OF LIQ
MN	L,M,C,T,O	$100	$300,000		2%/ACCOUNT	RP	FOL & INSOLV
MS	L,M,D,S,C,T,O	$100	$300,000		1% TOT PREM	RP	INSOLV ONLY
MO	L,AH,M,D,S,C,T,O	$100	$300,000	GD	1%/ACCOUNT	33% PTO	FOL & INSOLV
MT	L,M,D,S,C,T,O	$100	$300,000		2% TOT PREM	RP	INSOLV ONLY
NE	L,AH,F,M,S,C,T,O	$100	$300,000	PLF,GD	1%/ACCOUNT	20% PTO	FOL & INSOLV
NV	L,AH,M,S,T,O	NONE	$300,000	PLF	2% TOT PREM	20% PTO	FOL & INSOLV
NH	L,AH,M,D,C,T,O	$50	$300,000		2% TOT PREM	RP	INSOLV ONLY
NJ	L,AH,M,D,C,T,O,W	NONE	$300,000	PD	2% TOT PREM	PS	INSOLV ONLY
NM	L,AH,F,M,D,C,T,O	$25	$100,000	PLF	2% ACCOUNT	RP	FOL & INSOLV
NY	L,AH,F,M,D,C,T	NONE	$1,000,000		SEE NOTE 3	RP	INSOLV OF INS
NC	L,AH,F,M,D,S,C,T,O,W	$50	$300,000	PD	2%/ACCOUNT	RP	FOL & INSOLV
ND	L,AH,M,S,C,T,O	$100	$300,000		2% TOT PREM	RP	INSOLV ONLY
OH	L,AH,M,S,T,O	NONE	$300,000		1.5%/ACCOUNT	RP	INSOLV & LIQ
OK	L,AH,F,M,S,C,T,O	NONE	$150,000	PLF,PD	SEE NOTE 3	RP	INSOLV & LIQ
OR	L,AH,M,S,C,T,O	NONE	$300,000		2% TOT PREM	20% PTO	FOL & INSOLV
PA	L,AH,M,S,C,T,O,W	$100	$300,000		2%/ACCOUNT	RP	INSOLV ONLY
PR	L,AH,M,D,T,O	$50	$150,000		2%/ACCOUNT	PS	INSOLV ONLY

RI	L,AH,F,M,D,S,C,T,O	NONE	$300,000	PD	2%/ACCOUNT	RP	FOL & INSOLV
SC	L,AH,F,M,S,C,T,O	$250	$300,000	PD	1%/ACCOUNT	RP	INSOLV ONLY
SD	L,AH,F,M,D,S,C,T,O	$100	$300,000	PD	1%/ACCOUNT	RP	INSOLV ONLY
TN	L,AH,M,D,S,C,T,O	$100	$100,000	GD	1%/ACCOUNT	25% PTO	INSOLV ONLY
TX	L,F,M,S,C,T,O	NONE	$100,000	PLF,PD	2% CVRD LOB	20% PTO	INSOLV ONLY
UT	L,F,M,D,S,C,T,O	$100	$300,000	PLF,PD	2%/ACCOUNT	20% PTO	FOL & INSOLV
VT	L,AH,M,S,C,T,O	NONE	$300,000	PLF	2%/ACCOUNT	RP	INSOLV ONLY
VI	L,M,D,S,C,T,O	$50	$50,000	PLF	3% TOT PREM	RP	INSOLV ONLY
VA	L,AH,F,M,D,S,C,T,O	NONE	$300,000	PD	2%/ACCOUNT	RP	FOL & INSOLV
WA	L,M,D,S,C,T,O,W	$100	$300,000		2%/ACCOUNT	20% PTO	INSOLV & LIQ
WV	L,M,D,S,C,T,O,W	$100	$300,000		2%/ACCOUNT	RP	INSOLV & LIQ
WI	F,M,S,C,T,O	$200	$300,000	PD	2%/ACCOUNT	RP	FOL
WY	L,M,D,S,C,T,O	$250	$150,000	PLF	1% TOT PREM	RP	FOL & INSOLV

SOURCE: Insolvency Notebook, National Conference of Insurance Guaranty Funds, 1991.

1. KEY: Life (L), accident and health (AH), financial guaranty (F), mortgage guaranty (M), disability (D), surety (S), credit (C), title (T), ocean marine (O), and worker's compensation (W).

2. KEY: Pre-liquidation fees (PLF), punitive damages (PD), and general damages (GD).

3. KEY: Total premiums (TOT PREM or TP), account (ACC), covered LOB (CVRD LOB). NY is a pre-assessment fund: pre-assessment is .5% of total premiums/quarter. In OK, formula for recoupment is lesser of 2% of total premiums or 1% of surplus.

4. KEY: Rates and Premiums (RP), premium tax offset (PTO), and policyholder surcharge (PS).

5. KEY: Final order or liquidation (FOL), final order of liquidation with a finding of insolvency (FOL & INSOLV), final order of insolvency only (INSOLV ONLY), finding of insolvency and liquidation order (INSOLV AND LIQ ORDER), appointment of a liquidator (APPOINT OF LIQ), and the insolvency of the insurer (INSOLV OF INS).

Krogh and Levin (1986), writing after the NAIC Model Act revisions of 1984, updated the literature on the status of insolvency funds in the various states. Olson (1986) traced the evolution of guaranty funds to the need to protect certain limited groups of insureds. He argues that the issues regarding guaranty funds have become "an earnest competition between proponents of state versus federal regulation of the insurance industry" (Olson, 1986, p 145).

Spenser (1990) reviewed the obligations of guaranty funds and analyzed expectations relative to original intentions at the founding of guaranty funds. His analysis indicates that the scope of the guaranty funds has come to exceed the original intention of the law. He gives good marks to the guaranty funds for their performance to date but questions the ability of the funds to survive continued losses at the level of recent years.

Meyer, Power, and Shows (1993) examined assessments on a geographic basis and concluded that states with higher assessments are not geographically proximate: Delaware, California, Maine, Florida, Minnesota, and Louisiana. They also suggested that higher assessments are explained by inadequate budgets for regulatory authorities. Their results also offer persuasive evidence that costs of property-casualty insurer insolvencies have been highly variable. They identify explanations for large variability of net assessments among states; these include by chance, differences in the relative economic importance of the states, and differences in regulatory effort expended.

Cummins (1988) pointed out that flat rate insolvency assessments by guaranty funds encourage high risk underwriting and investment policies by insurers. He develops models for risk-based

premiums and compares the risk based premiums to flat-rate premiums. Cummins concludes there is less distortion of incentives when risk-based premiums are employed by guaranty funds. Likewise Feldhaus and Barth (1992) develop a model for risk-based pricing to be used by guaranty funds to determine assessment based on characteristics of individual companies.

Determinants of Assessments and Research Methodology

This paper examines macroeconomic and industry factors that explain the level of total assessments on a state-by-state basis.[1] A general model focusing on macroeconomic and industry-specific variables is developed. An explanation for the level of net assessments should logically be found in the causes of insolvencies. A recent study cites multiple causes of insolvencies including: excessive competitive zeal resulting in inadequate pricing, too rapid growth, alleged fraudulent actions of owners or managers, deficient loss reserves, overvalued assets resulting from poor investment policies, significant changes in insurance business (including entrance into new lines of business for which the insurer is poorly qualified), reinsurance company failures, and catastrophic losses (A.M. Best, 1991).

For purposes of model development we have differentiated between those causes that are micro level (insurer specific) and those that are macro level (more general to the insurance market). Several of these variables have ambiguous relationships to solvency. Inadequate pricing can be explained by insurer-specific events such as poor judgement or management; alternatively, inadequate pricing could also be influenced by competitive market factors such as soft market conditions that existed in the early 1980s and some would say today. In soft markets companies apparently engage in price competition to gain market share at the expense of good underwriting practices. High interest rates also can lead to soft markets as insurers compete for dollars to invest in high yielding securities. Reducing this to macro level terms in the model, soft market conditions are expected to be associated with interest rate changes and the degree and extent of price competition in the market.

Rapid growth is often cited as a cause of insolvency (and thus assessments). Rapid growth can be viewed as a characteristic of a particular company or viewed in an industry framework. Companies grow rapidly by expanding their writing relative to surplus, which is accompanied by deficit loss reserves and a deterioration in the company's ability to manage its book of business. On the other hand, soft markets as a business condition can mean too rapid growth for all insurers and thus is a macro level condition. Hence, the variable interest rates, if associated with soft markets, might signal higher levels of assessments.

Other identified causes—alleged fraud, overstated assets, and significant change in lines of insurance business—are primarily influenced by insurer specific factors. These factors are compounded by alleged (by the GAO) regulatory deficiency in insurance departments. The GAO

[1] Initially, a study of individual state guaranty fund characteristics was con ducted to identify variables influencing net assessments. A pretest correlation analysis of classification variables relating to covered lines, guaranty fund deductibles, non-covered claims, maximum annual assessments, net worth provisions, extent of coverage of unearned premiums, recoupment provisions, and guaranty fund triggers provided no significant correlations with net assessments. This in itself is an interesting and counterintuitive finding: net assessments seem to be independent of the characteristics and differences between guaranty fund design. It was proffered earlier that premium tax credit insolvency funds would seem to entail fewer subsidies of risk taking, but these findings offer no support for that proposition.

cites as important causes field examinations only once in three to five years, inadequate funding for approximately 40 percent of insurance departments, and unreasonable delays in sharing data. The GAO even suggests active concealment of information between state insurance departments as insolvencies develop (GAO, 1989).

Many of these structural characteristics are specific to the state guaranty funds, therefore, they are difficult to include in a general model. However, the omission of relevant state effect variables can result in a potentially complex structure of the error term and could bias the regression estimators. Reinsurance failure is believed to have been a leading cause of insolvencies in the 1980s. Reinsurance transactions may contribute to the problem but aggregate data reported by insurers masks or distorts the loss experience of insurers. Annual statements before 1989 combined primary insurance and reinsurance data, making it difficult to detect true loss experience (GAO, 1990). Although there is little reason to believe that there are systematic differences in reinsurance abuse among states, the possibility that systematic differences influence net assessments should not be dismissed.

Another major cause identified by A.M. Best is catastrophic losses. Although P&C insurers can arrange for catastrophe reinsurance, many insurers have inadvertently or deliberately retained exposures for highly unusual property losses. Insurers with limited geographic or by line diversification are particularly vulnerable to catastrophes. Very large insolvencies also can have a dramatic effect on assessments. The Mission Insurance failure, estimated at $458.6 million, led to very large assessments (A.M. Best, 1991).

The empirical model incorporates five variables to explain the variability in net assessments. Net assessments is taken to be gross assessments less amounts recovered. These five variables are: net premiums written in the previous year; the average level of catastrophes in the preceding five years; the average market share of leading insurers in each state's insurance market in the previous five years; the average of changes in interest rates in the previous five years; and the market share of large insurer insolvencies at the time of insolvency. These are described as follows:

1. Lagged Direct Written Premiums Direct written premiums is the direct measure of the amount of insurance business conducted in the state; therefore, it is a measure of economic activity in the insurance business. It would be expected that assessments will vary directly with direct premiums written. Assessments for various guaranty funds are determined as a percentage of that member's direct written premiums in the base year. In this model, direct written premiums are lagged one year as an explanatory variable since guaranty funds assess member insurers based upon their proportionate share of premiums written (in that state) in the preceding year.

2. Catastrophes Catastrophic events such as hurricanes would be expected to increase insolvencies and consequently net assessments. A.M. Best (1991) identifies 17 catastrophes between 1969 and 1990. The five-year moving average (lagged one year) of the dollar value of catastrophes is used as an independent variable to explain the level of net assessments. It would be anticipated that catastrophes could differentially impact large versus small insolvency funds.

3. Market Concentration Ratio Market concentration should be associated with higher net assessments. The concentration ratio variable used is an indicator of market dominance by the leading property and liability insurers in a state. A highly concentrated market leads to intense

competition between the remaining smaller firms. Munch and Smallwood (1980) find support for the level of competition as an important determinant of the probability of insolvency for individual insurers. To gain market share, smaller firms compete on a price basis, and the possibility of inadequate rates arises. Thus, the level of competition in the state might influence failures and hence net assessments. The concentration ratio used is the market share (direct written premiums) of the three leading property and liability insurers. The market concentration ratio variable is a five-year moving average (lagged one year) of concentration ratios for each state.

4. Interest Rate Changes The relationship between interest rate changes and net assessments can be interpreted in at least two ways. On the one hand, one would expect falling rates to improve general economic conditions and increase insurer portfolio values, thus reducing net assessments. On the other hand, rising interest rates tempt insurers to offset greater underwriting losses with higher investment income returns from investing incoming premiums. When interest rates are rising, cash flow is invested in higher yielding assets, resulting in substantial investment income contributions to operating income while underwriting income deteriorates. In short, high yields encourage cash flow underwriting. When insurers become dependent on high investment income and interest rates decline as they did after 1981, reduced cash flow from net investment income causes companies to have financial difficulties. Also, rising interest rates attract new capital to the business and increase competition. When interest rates fall, insurers find themselves operating under inadequate rate structures that are not offset with investment income. Therefore, net assessments and interest rate changes are expected to be negatively related. Interest rates changes are calculated for 10-year Treasury securities. The moving average of interest rate changes for five years leading to the year of net assessments is used as the average interest rate change variable.

5. *Market Share of Large Insolvent Insurers* Large insurer insolvencies result in increases in net assessments to states beyond the state of domicile. The market share of direct premiums written for large insolvent insurers as a proportion of total direct premiums written in the state at the time of insolvency is a direct indicator of the differential impact of large insurer insolvencies.[2] Guaranty funds that experience failures of insurers whose direct premiums written are substantial relative to their market are expected to have higher levels of net assessments.

The model is specified as follows:

$$\begin{aligned} NA_{i,t} = \alpha &+ \beta_1 DWP_{i,t-1} + \beta_2 ACAT_{i,at} + \beta_3 ACR_{i,at} + \beta_4 ACIRATE_{at} \\ &+ \beta_5 MSLII_{it} + \beta_6 ACAT_{i,at} * DWP_{i,t-1} \\ &+ \beta_7 ACIRATE_{at} * DWP_{i,t-1} + \epsilon_{i,t} \end{aligned} \quad (1)$$

[2] The insolvent insurers and costs used for the development of the variable are: Mission Insurance Group ($393.25 million), Midland Insurance Company (S172.74 million), Champion Insurance Company ($94.34 million), Carrier Insurance ($92.37 million), Iowa National Mutual ($71.87 million), Coastal Insurance Company ($57.86 million), Allied Fidelity Insurance Company ($52.49 million), American Excel ($43.35 million), Homeland Insurance Company ($34.35 million), Professional Mutual Insurance ($27.16 million), Cadillac Insurance Company ($13.66 million), Consumer Indemnity *Company* ($11.71 million), Eastern Indemnity Company ($9.98 million). These companies were selected because of size of insolvency, the necessity of completing the data matrix for all years of the study, and data availability from the Schedule Ts reported to the NCIGF. In many cases, the direct premiums written data are not available for the year of insolvency. Therefore, the closest year of data availability was used.

where:

$NA_{i,t}$	=	net assessments of year t for state i ($ millions)
$DWP_{i,t-1}$	=	direct written premiums of year t-1 for state i in constant dollars ($ millions)
$ACAT_{i,at}$	=	average of catastrophes (year t-5 to year t-1) for state i in constant dollars ($ millions)
$ACR_{i,at}$	=	average of percent market share (year t-5 to year t-1) for three leading insurers for state i
$ACIRATE_{at}$	=	average of interest rate changes (year t-5 to year t-1) for 10-year Treasury securities
$MSLII_{i,t}$	=	market share ratio held by large insolvent insurers at the time of insolvency for state i
ϵ_{it}	=	disturbance term

In modeling a regression relationship, a non-proportionate relationship between independent variables can often be explained by accounting for size differences. Interaction variables are useful for identifying such effects. Two interaction variables are included that capture the effect of size. These are interaction effects of catastrophes and interest rate changes with direct premiums written. By taking the derivative to equation (1) with respect to the appropriate variable, the interpretation of these interactions is as shown:

$$\partial NA_{i,t}/\partial DWP_{i,t-1} = \beta_1 + \beta_6 ACAT_{i,at} + \beta_7 ACIRATE_{at} \quad (2)$$

$$\partial NA_{i,t}/\partial ACAT_{i,at} = \beta_2 + \beta_6 DPW_{i,t-1} \quad (3)$$

$$\partial NA_{i,t}/\partial ACIRATE_{at} = \beta_4 + \beta_7 DPW_{i,t-1} \quad (4)$$

Because the model is a pooled cross-sectional and time series design, the applicability of OLS needs to be tested.[3] In addition to OLS, fixed effects and random effects results are reported.[4]

Data

This study examines the net assessments for 49 states and the District of Columbia for the 12-year period from 1979-1990. The National Conference of Insurance Guaranty Funds (NCIGF) provided data for 1979-90 by state.[5] This 12-year period coincides with a large increase in insurer insolvencies, particularly evident since 1984. Tables 2 and 3 report the frequency of insolvencies, first in aggregate and then on a per state basis. Casual observation of Table 2 would indicate an increasing trend of insolvencies since the middle of the 1980s. Insol-

[3] The use of ordinary least squares assumes that the intercept remains constant over time and by state. Conversely, a fixed effect permits the intercept to vary by state. A random effects model was also tested. This model assumes that the intercept terms are normally distributed. The use of a fixed effects model forces no restrictions on the pattern of intercepts whereas the random effects model does. The primary advantage of the random effects model is efficiency. All three model specifications are reported in the paper.

[4] A two-factor fixed effects model was found to be inappropriate because the period factor was highly correlated with the interest rate and interaction variables. Moreover, the GNP deflator was applied to all dollar value variables in the regressions to remove most of the trend explainable by the time period dummy variables.

[5] New York is a pre-assessment state and does not report to the NCIGF.

TABLE 2

Number of Insolvencies and Net Assessments Charged by State Guaranty Funds by Year of Liquidation

Year	Number of Insolvencies[1]	Net Assessments ($ Millions)
1969–78	58	$129.2
1979	3	45.0
1980	5	19.0
1981	5	47.7
1982	9	39.5
1983	4	35.4
1984	19	119.6
1985	25	292.8
1986	27	529.1
1987	19	902.2
1988	19	426.9
1989	41	716.0
1990	34	454.5
Year not Specified	0	13.4
Total	210	3,770.3

Source: National Conference of Insurance Guaranty Funds: Insolvency Notebook, 1992; NCIGF Statistical Information through December 31, 1990. Includes 50 states, District of Columbia, Puerto Rico, and the Virgin Islands.

[1]The number of insolvencies reported by the National Conference of Insurance Guaranty Funds (NCIGF) differs from Best's Insolvency Study of Property/Casualty Insurers 1969–90, June 1991. The NCIGF data in this table are based on year of insurer liquidation.

TABLE 3
Ranked Number of Insolvencies for States
from 1979–90 and 1969–1978[1]

State	Number of Insolvencies (1979–90)
TX	31
NY	19
CA	18
PA	15
IL	12
FL,LA	11
DE,OK	9
OH	7
AZ	5
IN,MO,OR	4
CO,IA,PR,SC,WV,WY	3
AL,GA,KY,MA,MN,MT,NE,NM,RI,TN,WA	2
AK,HI,MD,MI,NV,NJ,NC,UT,VI,VT,WI	1

State	Number of Insolvencies (1969–78)
PA	11
NY	8
CA	7
FL,IL,MO	4
MI	3
MA,OH,PR,WI	2
CO,GA,IA,ME,MD,MT,NH,NJ,TX	1

Source: National Conference of Insurance Guaranty Funds: Insolvency Notebook, 1992. Includes 50 states, District of Columbia, Puerto Rico, and the Virgin Islands.

[1]States or territories excluded from table had no insolvencies during the time period specified.

vencies often have long tails of liability according to the line of insurance. The recent financial distress of the Lloyds of London is often attributed to long ago liability coverages. Table 3 indicates that Texas, New York, California, Pennsylvania, Illinois, Florida, and Louisiana were the states most prone to insolvencies in the 1979-90 period.

The regression analysis uses net assessments by state for 19841990 instead of the longer 12-year period, although data for the independent variables come from 1979-1983. This 7-year sub-period was chosen for several reasons. First, Table 2 shows a clear pattern that begins in 1984. Second, some state guaranty funds, such as in Oklahoma and Alabama, established insurance guaranty fund association acts as late as 1980 and 1981, respectively. Therefore, in efforts to employ a reasonably homogeneous data set, regressions were conducted using data for 1984-90.

In addition to net assessments, direct written premiums, adjusted loss ratios and the three-insurer market concentration, data were compiled from various issues of Best's Review. Direct written premiums by state were available from the Insurance Fact Book for years 19791990. The

Property Claim Services Group provided the catastrophe record in the State History Report 1979-1992. The record detailed the state, time period, perils, and dollar estimate of losses. A catastrophe is defined as an event that causes in excess of $5 million in insured property damage and affects a significant number of insureds and insurers.

Results

Table 4 shows a summary of mean net assessments charged by 49 states and the District of Columbia. The top 10 states in mean net assessments are California, Florida, Texas, Illinois, Michigan, Louisiana, Pennsylvania, Minnesota, Massachusetts, and Connecticut. Examining the mean change in net assessments from 1979 to 1990 reveals that 8 of the 10 seem to also have substantial increases; the mean change in net assessments for Connecticut and Minnesota appears to be more in-line with other states. Maine, Rhode Island, and Georgia also have had large increases in mean net assessments over the 12-year period.

The foregoing does not allow for differences in the amount of insurance sold in each state. In the fourth column of Table 4, net assessments are divided by direct written premiums. The resulting ratio is multiplied by 100 and can be interpreted as the net assessments fin fractions of a dollar) per 100 dollars of direct written premiums. For Florida, 42.5 cents (80.425) from every $100 of direct written premiums goes toward the guaranty fund. While the ratio indicates high financial costs per dollar of premiums for states such as Louisiana, Minnesota, Florida, and California, it also fails to suggest similarly

TABLE 4
Summary of Net Assessments by State (and District of Columbia) for 1979–90

State	Mean Net Assessments	Mean Δ in Net Assessments	Mean Net Assessments to Mean DWP Ratio	Mean Δ in Net Assessments to Mean Δ in DWP Ratio
AK	$ 1,155,942	$ 340,504	0.00237	0.00990
AL	4,552,328	1,212,687	0.00239	0.00744
AR	1,524,940	70,010	0.00132	0.00078
AZ	3,184,250	−68,182	0.00167	−0.00042
CA	81,507,104	3,939,251	0.00387	0.00202
CO	2,865,392	−17,050	0.00148	−0.00010
CT	7,804,603	133,484	0.00267	0.00048
DC	738,590	110,386	0.00150	0.04720
DE	2,417,596	636,364	0.00526	0.01280
FL	31,031,413	1,991,004	0.00425	0.00266
GA	5,881,643	1,378,947	0.00167	0.00375
HI	2,895,887	−72,718	0.00388	−0.00090
IA	2,887,143	9,545	0.00183	0.00011
ID	748,994	0	0.00151	0.00000
IL	14,770,432	2,269,062	0.00197	0.00445
IN	1,014,758	222,645	0.00037	0.00111
KS	1,635,565	109,091	0.00112	0.00115
KY	2,299,386	504,359	0.00132	0.00461
LA	13,283,206	5,383,920	0.00478	0.03721
MA	9,307,309	2,247,295	0.00195	0.00519
MD	3,727,000	254,182	0.00128	0.00092
ME	4,413,193	2,083,648	0.00597	0.02987
MI	13,678,943	1,868,250	0.00233	0.00526
MN	10,871,792	263,046	0.00379	0.00143
MO	3,767,748	695,800	0.00131	0.00318
MS	1,895,574	0	0.00160	0.00000
MT	2,337,900	−7,324	0.00536	−0.00029
NC	2,098,813	911,954	0.00074	0.00320
ND	366,489	0	0.00100	0.00000
NE	692,240	1,358	0.00075	0.00002
NH	1,690,318	401,785	0.00208	0.00581
NJ	0	0	0.00000	0.00000
NM	1,075,481	−58,495	0.00141	−0.00104

TABLE 4 (*continued*)

State	Mean Net Assessments	Mean Δ in Net Assessments	Mean Net Assessments to Mean DWP Ratio	Mean Δ in Net Assessments to Mean Δ in DWP Ratio
NV	1,471,761	11,825	0.00238	0.00019
OH	5,117,225	−132,558	0.00099	−0.00042
OK	6,251,228	501,591	0.00347	0.00492
OR	2,040,747	0	0.00125	0.00000
PA	10,854,120	3,074,574	0.00140	0.00500
RI	2,504,077	1,611,658	0.00362	0.02546
SC	2,474,080	806,036	0.00151	0.00538
SD	432,157	0	0.00122	0.00000
TN	1,608,468	0	0.00067	0.00000
TX	18,249,817	3,727,954	0.00174	0.00409
UT	1,000,868	0	0.00155	0.00000
VA	2,295,837	43,639	0.00075	0.00016
VT	508,344	34,184	0.00146	0.00107
WA	2,860,809	622,667	0.00124	0.00309
WI	3,433,758	761,329	0.00134	0.00356
WV	756,730	−6,000	0.00102	−0.00011
WY	288,237	84,585	0.00117	0.00742
US	$6,003,785	$759,126	0.00203	0.00495

high costs for states such as Texas, Pennsylvania, and Illinois, which rank high in number of insolvencies, as shown in Table 3. Other states such as Maine and Montana show high ratios but are low on the list of number of insolvencies. Clearly, these small states were seriously impacted by a few insolvencies.

In the last column, the mean change in net assessments is divided by the mean change in direct written premiums to determine a standardized measure of the change in net assessments. In particular, the District of Columbia, Louisiana, Maine, Rhode Island, and Delaware show the largest ratios, and, therefore, the largest increase per dollar increase in direct written premiums. Although the data in Table 4 show some uniformity in the identification of problem guaranty funds, a multivariate analysis can assist in the identification of problem funds, and more fundamentally, help determine the significance of variables that explain the level of net assessments of state guaranty funds.

Table 5 shows the regression results using three models: ordinary least squares, a fixed effects model, and a random effects model. The

TABLE 5
Regression of Net Assessments as the Dependent Variable for Guaranty Funds for 49 States and District of Columbia from 1984–90

Variable	OLS Coefficient	Fixed Effects Coefficient	Random Effects Coefficient
Constant	−17.348	−26.422	−18.967
	(−2.35)[c]	(−0.80)	(−2.15)[c]
$DWP_{i,t-1}$	0.301E-02	0.965E-02	0.345E-02
	(6.20)[a]	(6.92)[a]	(6.54)[a]
$ACAT_{i,at}$	0.166E-02	0.876E-02	0.303E-02
	(0.90)	(3.89)[a]	(1.62)
$ACR_{i,at}$	0.520	0.809	0.541
	(1.87)[d]	(0.71)	(1.62)
$ACIRATE_{at}$	7.265	6.535	7.029
	(2.89)[b]	(2.79)[c]	(3.00)[b]
$MSLII_{i,t}$	1.318	1.371	1.252
	(3.04)[b]	(3.19)[b]	(3.04)[b]
$ACAT_{i,at}$*$DWP_{i,t-1}$	−0.955E-06	−0.381E-05	−0.139E-05
	(−2.54)[c]	(−5.77)[a]	(−3.33)[a]
$ACIRATE_{at}$*$DWP_{i,t-1}$	−0.395E-02	−0.264E-02	−0.383E-02
	(−7.41)[a]	(−4.78)[a]	(−7.68)[a]
F-Value	68.73[a]	11.71[a]	—
Adjusted R^2	0.58	0.63	0.58
Observations	350	350	350
Est. Autocorrelation	−0.12	−0.12	−0.12
Model Tests:			
State Dummies (F-Value)	—	2.07[a]	—
LM (Model 3 vs. 1)	—	—	2.55
Hausman (Model 3 vs. 2)	—	—	0.1E-03

a. Significant at the 0.1% level.
b. Significant at the 1% level.
c. Significant at the 5% level.
d. Significant at the 10% level.

fixed effects model includes shift (dummy) variables for each state. A comparison of the error sum of squares of the OLS and fixed effects models (with state shift parameters) shows a statistically significant F- value of 2.07; therefore, the addition of shift parameters appears to somewhat improve the explanatory capacity of the regression. Because of the large number of shift parameters associated with the fixed effects regression and the extensive use of degrees of freedom, it is desirable to determine if the random effects model is appropriate.[6] The Breusch and Pagan (1980) LM statistic, which compares the random effects model (3) with the OLS

[6]Both the fixed and random effects models give unbiased and consistent estimates; however, the random effects model is more efficient if appropriate. The random effects model assumes that the shifting regression intercepts from the state shift parameters follow a normal distribution (Pindyck and Rubinfeld, 1981). The random effects approach, however, assumes that individual effects are uncorrelated with the remaining regressors. Therefore, the random effects model can suffer from inconsistency due to omitted variables (Green, 1990). A Lagrange multiplier (LM) test for the random effects model versus OLS is based on the residuals of the OLS model.

model, is statistically insignificant. Therefore, the evidence in favor of the random effects model is not compelling, and the OLS regression looks adequate. The small and insignificant value for the Hausman statistic suggests the hypothesis that the individual effects are uncorrelated with remaining independent variables should not be rejected.[7] Therefore, the random effects model estimates of the regression are found to be statistically consistent. In both the fixed and random effects models, the estimated autocorrelation is —0.12, which does not appear to be problematic. These tests appear to favor the OLS regression from a standpoint of efficiency; however, all three model results are analyzed.

The OLS regression results indicate that direct written premiums are by far the most influential variable explaining the variability in net assessments. In the absence of catastrophes and with no interest rate change, net assessments increase $0.30 per 100 dollars of direct premiums written. When interaction terms are included and the variables are nonzero, however, the effect of direct premiums written depends on the level of catastrophes and interest rate changes. Allowing for interaction effects [using equation (2)1, at the mean levels of catastrophes ($260.14 million) and interest rate change (-0.4843%), net assessments increase $0.47 per hundred dollars of direct written premiums. The t-statistic for this variable is significant at .1 percent. The random effects model shows a similar estimate of $0.34 per hundred dollars of net premiums written without interactions and $0.49 with interactions, while the fixed effects estimates are higher at $0.96 and $0.99, respectively.

The average catastrophes variable is positively related to net assessments with net assessments increasing by $0.17 per hundred dollars of catastrophes when direct premiums written is at zero. Because the t-statistic of 0.90 is not significant, however, the stability of the coefficient is not established. The interaction term of catastrophes and direct premiums written is statistically significant at the 5 percent level and indicates that the impact of catastrophes on net assessments varies inversely with the level of direct premiums written. Using the mean of the interaction variable ($1,606,200), the interaction effect reduces net assessments by $1.53 million. The random effects and fixed effects models estimated the interaction effect at reducing net assessments by $2.23 million and $6.12 million, respectively. Therefore, at low levels of direct written premiums, the increase in assessments due to catastrophes is greater on a per dollar basis than for larger states (i.e., at higher levels of direct premiums written). Consequently, an increase in the size of the net premiums written pool of a state serves to decrease the impact of catastrophes on net assessments in a state. The logical conclusion is that larger guaranty funds in larger states (and larger insurance markets) are less susceptible to shocks to the fund from catastrophes.

The concentration ratio regression coefficient shows a positive and statistically significant relationship with net assessments providing evidence that more concentrated insurance markets are associated with greater assessments. In the OLS model, each 1 percent increase in concentration ratio increases net assessments by $0.52 million. The random effects model has a statistically significant coefficient that estimates the effect of concentration at $0.54 million for each 1 percent increase in concentration. While the fixed effects model estimate is larger at $0.81

[7] A test of the appropriateness of random effects model is a test comparing the variance matrix of the estimators of the fixed and random effects models (Hsiao, 1986). This test is commonly known as the Hausman statistic (Hausman, 1978).

million, the regression coefficient is not statistically significant. A possible explanation for this strong positive relationship is that the more a state's market tends to be dominated by a few leading insurers, which forces the smaller market share companies to compete by price cutting, the more those weaker companies fail, thereby resulting in higher assessments.

Another important variable is interest rates. The regression results for the interest rate coefficient shows that falling interest rates have mitigated increases in net assessments during a period when assessments were rising. If the interaction between interest rates and direct premiums written were zero, a 1 percent average decrease in interest rates would cause net assessments to fall by $7.26 million. The interaction variable for interest rates and direct premiums written is statistically significant at the .1 percent level, therefore, the interest rate interpretation changes. Applying equation (4) at the mean level of direct premiums written ($3,583.19 million), the impact of the interest rate coefficient and the interaction variable is to increase net assessments by $6.87 million (per 1 percent decrease in interest rates) instead of the $7.26 million decrease reported above. The random effects model and, to a lesser extent, the fixed effects model estimate a similar relationship; both alternative models are statistically significant at the 1 percent level. These results suggest that the effect of interest rate changes is different in states with large guaranty funds. In these large insurance markets, falling interest rates are associated with rising net assessments. When interest rates decline in the larger markets, net assessments increase, which is contrary to the general finding that falling interest rates are associated with declining net assessments. Although this contrary relationship is surprising, these results could be driven by the type of insurers that operate in large versus small markets. If large insurers dominate in large markets and if large insurers engage in more cash flow underwriting, then declines in interest rates would substantially decrease their investment income and explain the inverse relationship. In any event, these findings suggest that something is happening in the larger markets that is different from the smaller markets, and it overwhelms the general positive effect on assessments of declining interest rates.

Another variable included is the direct written premiums of large insurers that became insolvent as a percentage of direct written premiums. Large insurer insolvencies create disproportionately high net assessments, especially in markets where their role is substantial. The relationship was positive as one would certainly expect. Regulatory concentration on preventing large insolvencies appears warranted given the strong statistical significance of this variable.

Table 5 provides some insight to the variables influencing net assessments. It does not indicate whether the relationship between lagged direct written premiums and net assessments is largely the same or different among states. A test for common slopes of the lagged direct written premiums variable by state indicates a significant interaction.[8] Therefore, a separate slope model was examined to identify states that had large increases in net assessments per dollar of lagged direct written premiums. The interaction of state with lagged direct written premiums creates 50 additional interaction variables.

Table 6 shows the slope coefficients of direct written premiums for 49 states and the District of Columbia. The model explains 70 percent of the variation in net assessments over the 7-year

[8] Although not reported in the tables, the separate slopes interaction variable was significant at the 0.1 percent level even in the presence of the lagged direct premiums written as the main effect.

period. Only California and Massachusetts have large, positive, and statistically significant coefficients. These states have had large increases in net assessments based on lagged direct written premiums even when controlling for the other independent variables.

Conclusions and Implications

This paper finds that net assessments by guaranty funds are explained by several variables. The level of economic activity as measured by net premiums written in the P&C insurance industry is found to be a prime determinant of net assessments. This factor is captured by lagged direct written premiums in the state. In addition, one would expect that the level of catastrophes would increase net assessments. When the aggregate data are examined, the effect of catastrophes is not strong in two (OLS and random effects) of the three models tested. When catastrophes are considered in conjunction with size, a very interesting and robust finding emerges: the size factor overwhelms the effect of catastrophes. This finding implies that smaller guaranty funds are vulnerable to significant disruptions in the form of higher net assessments. Firms operating in smaller markets are likewise subject to greater uncertainty regarding their contribution to the fund. This finding lends support to arguments for national guaranty funds and, indeed, regulation of insurance.

Market concentration also appears to influence net assessment levels. Specifically, higher market concentration levels are associated with higher net assessments, presumably because price pressure by the lead insurers results in insolvencies by smaller competitors. Moreover, insolvencies might be once again on the rise in the near term in the face of the dramatic decline in interest rates in recent years.

The big guaranty funds seem to be unfavorably influenced by interest rate declines whereas smaller state guaranty funds have lower assessments when interest rates fall. It may be that this is explained

TABLE 6

Fixed Effects Regression of Net Assessments as the Dependent Variable with Interaction of State and Lagged Direct Written Premiums Guaranty for Guaranty Funds for 49 States and District of Columbia from 1984–90

Variable	Fixed Effects Coefficient	t-Value
Constant	−47.226	−0.51
$ACAT_{i,at}$	0.017	4.12[a]
$ACR_{i,at}$	1.18	0.71
$ACIRATE_{at}$	−0.142	−0.05
$MSLII_{i,t}$	0.915	2.12[b]
$ACAT_{i,at}$*$DWP_{i,t-1}$	−0.620E-05	−9.44[a]
$ACIRATE_{at}$*$DWP_{i,t-1}$	−0.153E-02	−2.84[b]
AK*$DWP_{i,t-1}$	0.0258	0.27
AL*$DWP_{i,t-1}$	0.0424	1.43
AR*$DWP_{i,t-1}$	−0.0080	−0.29
AZ*$DWP_{i,t-1}$	−0.0032	−0.26
CA*$DWP_{i,t-1}$	0.0205	12.08[a]
CO*$DWP_{i,t-1}$	0.0031	0.17
CT*$DWP_{i,t-1}$	0.0045	0.57
DC*$DWP_{i,t-1}$	0.0146	0.29
DE*$DWP_{i,t-1}$	0.0128	0.27
FL*$DWP_{i,t-1}$	−0.0015	−0.45
GA*$DWP_{i,t-1}$	0.0020	0.35
HI*$DWP_{i,t-1}$	−0.0159	−0.40
IA*$DWP_{i,t-1}$	0.0097	0.29
ID*$DWP_{i,t-1}$	−0.0138	−0.17
IL*$DWP_{i,t-1}$	0.0035	0.85
IN*$DWP_{i,t-1}$	−0.0005	−0.04
KS*$DWP_{i,t-1}$	−0.0032	−0.11
KY*$DWP_{i,t-1}$	−0.0037	−0.19
LA*$DWP_{i,t-1}$	0.0245	0.89
MA*$DWP_{i,t-1}$	0.0113	2.07[b]
MD*$DWP_{i,t-1}$	−0.0001	−0.01
ME*$DWP_{i,t-1}$	0.0266	0.84
MI*$DWP_{i,t-1}$	0.0039	0.75
MN*$DWP_{i,t-1}$	0.0004	0.03
MO*$DWP_{i,t-1}$	0.0026	0.27

Continued on next page

TABLE 6 (*continued*)

Variable	Fixed Effects Coefficient	t-Value
$MS*DWP_{i,t-1}$	0.0083	0.29
$MT*DWP_{i,t-1}$	−0.0131	−0.10
$NC*DWP_{i,t-1}$	0.0032	0.37
$ND*DWP_{i,t-1}$	−0.0018	−0.01
$NE*DWP_{i,t-1}$	−0.0022	−0.04
$NH*DWP_{i,t-1}$	0.0017	0.06
$NJ*DWP_{i,t-1}$	0.0008	0.20
$NM*DWP_{i,t-1}$	−0.0097	−0.17
$NV*DWP_{i,t-1}$	−0.0002	−0.01
$OH*DWP_{i,t-1}$	−0.0010	−0.15
$OK*DWP_{i,t-1}$	−0.0041	−0.09
$OR*DWP_{i,t-1}$	−0.0107	−0.61
$PA*DWP_{i,t-1}$	0.0044	1.24
$RI*DWP_{i,t-1}$	0.0185	0.56
$SC*DWP_{i,t-1}$	0.0000	0.00
$SD*DWP_{i,t-1}$	0.0171	0.17
$TN*DWP_{i,t-1}$	0.0003	0.03
$TX*DWP_{i,t-1}$	−0.0019	−0.42
$UT*DWP_{i,t-1}$	0.0003	0.00
$VA*DWP_{i,t-1}$	−0.0004	−0.05
$VT*DWP_{i,t-1}$	−0.0123	−0.19
$WA*DWP_{i,t-1}$	0.0018	0.15
$WI*DWP_{i,t-1}$	0.0031	0.29
$WV*DWP_{i,t-1}$	−0.0118	−0.21
$WY*DWP_{i,t-1}$	0.0355	0.12
F-Value	—	8.66[a]
Adjusted R^2	—	0.70
Observations	—	550
State Dummies (F-Value)	—	2.31[a]
DWP_{t-1}*State (F-Value)	—	3.40[a]

a. Significant at the 0.1% level.
b. Significant at the 5% level.

[1]These results show the nested effects of state with direct written premiums in year t-1 (DWP_{t-1}). A Chow test with an F-Value of 2.31 (significant at the .1% level) for the interaction of DWP_{t-1} with state dummies indicates heterogenous slopes of lagged direct written premiums by state. The 50 dummy variable coefficients for states (and District of Columbia) and the time dummies are not reported in the table, though these dummies do appear in the regression model. For significant interaction coefficients, the coefficient can be interpreted as the increase in net assessments per dollar increase in direct written premiums.

by the greater presence of cash flow underwriting in the larger states. Possibly the large markets of large metropolitan areas are more competitive because of proximity of producers and companies and the presence of larger, national insurance companies. If larger market companies tend to depend more on investment income than underwriting income, declines in interest rates could cause financial distress and insolvencies in states where those companies play large roles. During the period of study, the decline in interest rates and falling yields combined with deteriorating underwriting income from earlier excessive cash flow underwriting resulted in operating income reaching a low point in 1984-1985 (A.M. Best, 1991).

The substantial disadvantage of smaller guaranty funds for covering catastrophes and the suggestion that decreases in interest rates cause net assessments in larger markets to increase suggests the need for larger guaranty funds to better weather losses from catastrophes and for stricter regulation of pricing and cash flow underwriting. These objectives argue for unification, consolidation, or even federalization of guaranty funds to encourage uniform management of insolvency assessments. Unification would also enhance the structural integrity of systems for funding insolvencies whose cause is linked to catastrophic events.

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